

CLAIMS

What is claimed is:

1. A method of increasing utilization of user
5 link bandwidth for a code division multiple access
communications system comprising the steps of:

selecting a set of orthogonal complex codes each
having a code length that is greater than a code length of
an optimum real code and less than or equal to a spreading
10 code length; and

transferring symbols across at least one of a
plurality of user links to or from at least one of a
corresponding plurality of user terminals wherein the
symbols are represented by a corresponding one of the set
15 of orthogonal complex codes.

2. The method of Claim 1 wherein the set of
orthogonal complex codes is generated from a Kronecker
tensor product given by formula:

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$$C_{L \times P} = A_L \otimes W_P$$

wherein

$C_{L \times P}$ is a matrix of orthogonal complex codes wherein
25 each of the orthogonal complex codes has a code length
equal to $L \times P$,

L is a positive integer,

P equals 2^n where n equals a positive integer,

W_P is a Walsh code matrix for a code length of P ,

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A_L is a matrix of coefficients a_{jk} wherein j is a row index equal to 1 ... L , k is a column index equal to 1... L , and

5
$$a_{jk} = e^{j2\pi(j-1)(k-1)/L}.$$

3. The system of Claim 1 wherein the corresponding one of the set of orthogonal complex codes has a code length of 12.

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4. The system of Claim 1 wherein the spreading code has a code length of 12.

5. A code division multiple access
15 communications system comprising:

a base station;

a geo-stationary platform;

a feeder link coupled to the base station and the
geo-stationary platform for transferring symbols between
20 the base station and the geo-stationary platform;

a plurality of user terminals; and

a plurality of user links coupled respectively to the
plurality of user terminals and to the geo-stationary
platform for transferring symbols between the geo-
25 stationary platform and at least one of the plurality of
user terminals wherein the symbols are represented by at a
corresponding one of a set of orthogonal complex codes
having a code length that is greater than a code length of
an optimum real code and less than or equal to a spreading
30 code length.

6. The system of Claim 5 wherein the set of orthogonal complex codes is generated from a Kronecker tensor product given by:

$$C_{L \times P} = A_L \otimes W_P$$

5 wherein

$C_{L \times P}$ is a matrix of orthogonal complex codes wherein the at least one of the orthogonal complex codes has a code length equal to $L \times P$,

L is a positive integer,

10 P equals 2^n and n equals a positive integer,

W_P is a Walsh code matrix for a code length of P ,

A_L is a matrix of coefficients a_{jk} , where j is a row index equal to $1 \dots L$, k is a column index equal to $1 \dots L$, and

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$$a_{jk} = e^{j2\pi(j-1)(k-1)/L}.$$

7. The system of Claim 5 wherein the at least one of the set of orthogonal complex codes has a code
20 length of 12.

8. The system of Claim 5 wherein the spreading code has a code length of 12.

25 9. A method of increasing utilization of user link bandwidth in a code division multiple access communications system comprising the steps of:
selecting a spreading code length; and
selecting a set of orthogonal complex codes each
30 having a code length that is greater than a code length of

an optimum real code and less than or equal to the spreading code length.

10. The method of Claim 9 further comprising the
5 step of transferring symbols across a user link to or from
a user terminal wherein the symbols are represented by a
corresponding one of the set of orthogonal complex codes.